

Applicant : Toshimitsu Taniguchi et al.  
Serial No. : 09/652,044  
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Attorney's Docket No.: 10417-039001 / F51-  
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### REMARKS

Claims 6-8, 10-24, 27 and 28 are pending. Claims 6, 7, 10, 12, 14 and 21-24 have been amended. Claims 1-5 have been withdrawn from consideration. Claims 9, 25, 26 and 29-33 have been canceled.

In light of the above amendments and the remarks below, respectfully request withdrawal of each of the rejections and objections and allowance of the application.

#### Claim Rejections 35 USC § 112

Claims 6, 7 and 29-30 are rejected as failing to comply with the written description requirement.

Claim 6 and 7 have been amended to clarify the subject matter. In particular, claims 6 and 7 have been amended to recite "forming a body layer of the first conductive type in direct contact with the source layer . . ." Claims 29 and 30 have been canceled. No new matter has been added.

In light of the above amendments and remarks, applicants respectfully request withdrawal of the rejections.

#### Claim Objections

Claim 21 has been objected to because of an informality.

Claim 21 has been amended to clarify the subject matter. In particular, claim 21 has been amended to a method wherein "said first MOS transistor is a micro MOS transistor; and said second MOS transistor is a MOS transistor having high resistance to voltage."

Claims 31 and 32 have been objected to for lacking antecedent basis.

Claims 31 and 31 have been canceled.

In light of the above amendments and remarks, applicants respectfully request withdrawal of the objections.

#### Claim Rejections 35 USC § 102

Claims 22-26 have been rejected under 35 USC 102(e) as being anticipated by Shida (US 6,033,944).

Claim 22 has been amended to recite:

22. (Currently Amended) A method of manufacturing a semiconductor device comprising:  
forming low concentration source/drain regions of a second conductive type in a semiconductor of a first conductive type;  
forming source/drain regions of a second conductive type in a semiconductor of a first conductive type;  
doping impurities of the first conductive type into the semiconductor of the first conductive type by ion implantation to form a semiconductor layer of the first conductive type comprising a channel located between the source/drain regions; and  
doping impurities of the second conductive type into the surface of the semiconductor layer of the first conductive type to form a second conductive type layer; and  
forming a gate electrode on a gate oxide film provided on the semiconductor of the first conductive type,  
**wherein the low concentration source/drain regions extends from under the gate electrode,**  
**wherein the low concentration source/drain regions of the second conductive type are formed to be in direct contact to the semiconductor layer of the first conductive type formed below the gate electrode by ion implantation,**  
**wherein the low concentration source/drain regions of the second conductive type is shallowly diffused in the surface of the semiconductor of the first conductive type to be in direct contact to the semiconductor layer of the first conductive type formed below the gate electrode by at least ion implantation.** (Emphasis Added)

Applicants submit that the Shida patent fails to teach or suggest at least the above bolded features for the following reasons.

The Shida patent shows (FIGS. 2a to 2d and 3) a device including source/drain regions 9 of high concentration of a second conductive type (N+). Although the Shida patent shows a low concentration layer of the second conduction type (N-) adjacent regions 9, it does not teach a low concentration source/drain region of the second conductive type as recited in claim 22. For example, the Shida patent shows (FIG. 2c) a (P) region between the low concentration source/drain regions of the second conductive type (N+), but fails to show a “low concentration source/drain region in **direct contact** to the semiconductor layer of the first conductive type

formed **below** the gate electrode" as recited in claim 22. Thus, the Shida patent does not anticipate claim 22 for at least this reason.

Claim 23 has been amended in a similar manner to claim 22. Since claim 22 should be allowable for the reasons above, claim 23 also should be allowable for at least the same reasons as claim 22.

Likewise, claim 24 has been amended in a similar manner to claim 22. Since claim 22 should be allowable for the reasons above, claim 24 also should be allowable for at least the same reasons as claim 22. Claims 25 and 26 have been canceled.

#### Claim Rejections 35 USC § 103

Claims 6-8, 10, 11, 16 and 17 have been rejected under 35 USC 103(a) as being unpatentable over Kao et al. (US 5,567,629). Claim 9 has been rejected under 35 USC 103(a) as being unpatentable over Kao in view of Chen et al. (US 5,926,712).

Claim 6 has been amended to recite:

6. (Currently Amended) A method of manufacturing a semiconductor device comprising:  
forming high concentration source/drain layers of a second conductive type in a semiconductor layer of a first conductive type;  
forming a gate electrode on a channel layer located between the source and drain layers; and  
forming a body layer of the first conductive type in direct contact with the source layer and a low concentration drain layer of the second conductive type formed between the channel layer and the drain layer,

wherein the body layer is formed only under the gate electrode, and wherein forming a body layer of the first conductive type comprises doping impurities of the first conductive type into said semiconductor layer by ion implantation,

**wherein said low concentration drain layer of the second conductive type or said low concentration source/drain layers of the second conductive type are formed so that they are shallow under said gate electrode and they are deep under said high concentration drain layer of the second conductive type or said high concentration source/drain layers of the second conductive type.**

(Emphasis Added)

Applicants submit that the Kao patent, alone or in combination with the Chen patent, fails to teach or suggest at least the above bolded features for the following reasons. FIG. 16 of the

Kao patent shows a low concentration layer 19 having a substantially even profile between source region 42 and drain region 44. The Kao patent points out (column 5, lines 45 to 50):

Such region 19, however, remains laterally inward relative to regions 42 and 44, thus providing an LDD function.

The LDD function helps prevent short channel effects such as a drop in threshold voltage ( $V_t$ ). (See column 1, lines 65 to 67; and column 1, lines 19 to 30) That is, the fact that region 19 remain laterally inward is important because it provides various advantages. FIGS. 2a -2e of Chen shows a source and drain region 216 that extends from under the gate of the device. However, one skilled in the art would **not** have been motivated to change the profile of region 19 in Kao to have a shallow and deep portion as recited in the bolded feature of amended claim 6. That is, there is no teaching or suggestion to combine the teachings of Kao and Chen to arrive at the claimed invention. Because, to change the profile of the region 19 of the Kao would increase the short channel effects which is undesirable, one skilled in the art would not have been motivated to modify region 19 of Kao. Thus, the prior art references fail to teach or suggest “low concentration drain layer of the second conductive type or said low concentration source/drain layers of the second conductive type are formed so that they are shallow under said gate electrode and they are deep under said high concentration drain layer of the second conductive type or said high concentration source/drain layers of the second conductive type” as recited in amended claim 6.

Claim 7 has been amended in a similar manner to claim 6. Since claim 6 should be allowable for the reasons above, claim 7 also should be allowable for at least the same reasons as claim 6. Claims 8 and 16 depend on claim 7 and should be allowable for at least the same reasons as claim 7. Claim 9 has been canceled.

Likewise, claim 10 has been amended in a similar manner to claim 6. Since claim 6 should be allowable for the reasons above, claim 10 also should be allowable for at least the same reasons as claim 6. Claims 11 and 17 depend on claim 10 and should be allowable for at least the same reasons as claim 10. Claim 29 has been canceled.

Claims 12-15, 18 and 19 have been rejected under 35 USC 103(a) as being unpatentable over Kao in view of Shida. Claims 20 and 30-33 have been rejected over a combination of Kao and Shida.

As explained above, claim 6 should be allowable over the prior art. Since claim 12 has been amended in a similar manner to claim 6, claim 12 should be allowable for at least the same reasons as claim 6. Claims 13, 18 and 20 depend on claim 12 and should be allowable for at least the same reasons as claim 12.

Claim 14 has been amended in a similar manner to claim 12. Since claim 12 should be allowable for the reasons above, claim 14 also should be allowable for at least the same reasons as claim 12. Claims 15, 19 and 21 depend on claim 14 and should be allowable for at least the same reasons as claim 14.

Claims 27 and 28 have been rejected under 35 USC 103(a) as being unpatentable over Kubo in view of Shida.

Claim 27 has been amended in a similar manner to claim 12. Since claim 12 should be allowable, claim 27 should be allowable for at least the same reasons as claim 12.

Likewise, claim 28 has been amended in a similar manner to claim 12. Since claim 12 should be allowable, claim 28 should be allowable for at least the same reasons as claim 12

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Respectfully submitted,

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